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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/774,157	01/29/2001	Richard Anthony Cox	7000/1	1034

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EXAMINER	
SODERQUIST, ARLEN	

ART UNIT	PAPER NUMBER
1743	

DATE MAILED: 01/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/774,157	COX ET AL.	
	Examiner	Art Unit	
	Arlen Soderquist	1743	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25 and 37-43* is/are pending in the application.

4a) Of the above claim(s) *37-43* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

1. It is noted by the examiner that the status of claims 37-43 is not given in the claim listing. Applicant is required (see the Official Gazette notice of February 25, 2003 regarding the currently required amendment format) to provide a complete list all claims with their current status. The text of claims that are canceled or withdrawn do not need to be provided and a single listing of consecutive claims that are in the same canceled or withdrawn status is permitted to reduce the space needed to provide the complete list of claims. Applicant is required to provide a complete listing of the claims in future amendments.

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the means for removing a gas as found in claim 5 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. There was no change to claim 5 and thus the objection is maintained with respect to that claim.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. Claims 1-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 is incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: a control which activates the equilibrium altering means so that there will be a change that the instrument can measure the first gas with the first gas sensor a plurality of times during the time that the change is occurring. The last paragraph of claim 1 should probably be a control means with the proper functional language such that the instrument is controlled to allow it to function to assay the concentration as found in the claim preamble. The dependent claims that contain functional language, e.g. claim 3, are also probably best presented as further limitations to a control means of the instrument. Also in claims 1 and 8 it is not clear how the "kinetics" of the reaction change through use of the equilibrium altering means since the instantly disclosed equilibrium altering means, the UV light source, changes the concentration of one of the components of the gas mixture and the process that follows is the reaction to either return to the original equilibrium or establish a new equilibrium based on the change. In claim 4 it is not clear if applicant is

attempting to limit the gas or the first gas sensor. If it is the gas, then the claim fails to further limit the claim from which it depends since the gas is not a positively recited element of the apparatus. If it is the first gas sensor that is being limited, then claim 4 is a duplicate of claim 6.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burrows, Cox, Hall, Johnston or Stuhl (middle three articles newly cited and applied) in view of Guicherit (full article newly cited).

In the paper Burrows teaches apparatus and method for observing kinetics of the reaction of hydroxyl radical with perhydroxyl radical by modulated photolysis of the ozone-water vapor system. Page 148 in the first paragraph teaches that the apparatus offers one of the few experimental systems that can provide kinetics information for a reaction (reaction (6) of page 147) that are difficult to measure. The third full paragraph of page 148 teaches that the difficult to measure reaction plays an important role in many laboratory systems and also in combustion and atmospheric chemistry. The molecular modulation technique was employed to observe the kinetic behavior of OH and HO_2 radicals in the 253.7 nm photolysis of O_3-H_2O-O_2-N_2 (or O_3-H_2O-O_2-He) mixtures at 1 atmosphere pressure. The radicals were monitored by absorption at 308.2 nm and 210 nm, respectively. O_3 was also monitored. The rate coefficient for the reaction $OH + HO_2 \Rightarrow H_2O + O_2$ was (determined by computer simulation) $k_6 = (6.2 \pm 4.0/2.0) \times 10^{-11}$ cm_3/mol-s, independent of temperature in the range 288-348 K. The possible role of HO_x

complexes in this reaction is discussed. In the last full paragraph of page 148 Burrows teaches that the modulated photolysis measures both the concentration and lifetime of the species. This paragraph also describes the apparatus as previously described in the below cited and applied Cox reference and includes a silica reaction cell irradiated by up to 6 low pressure mercury lamps at near 253.7 nm (Philips: TUV 30 W) modulated with a square wave at frequencies between 0.3 and 50 Hz. Detectors for the various components are also described. Burrows does not teach a detector for ozone, nitrogen monoxide or nitrogen dioxide.

In the paper Cox discusses kinetics of chlorine oxide radical reactions using modulated photolysis. The formation and decay of ClO radicals and OClO in mixtures of Cl_2 and O_3 in O_2 photolyzed at 298 K by square-wave modulated light were monitored using a time-resolved UV spectrophotometer. Quantum yields for the Cl-photosensitized decompomposition of O3 were also determined. ClO decayed by 3 parallel bimololecular reactions to $Cl_2 + O_2$, Cl + ClOO, and Cl + OClO and rate constants for these reactions were determined by computer simulation of the experimental concentration-time measurements for ClO, OClO, and O_3. The considerable departure from 2nd-order kinetics under modulated photolysis was interpreted in terms of formation of ClOOCl, which is sufficiently stable at 298 K to be kinetically significant. The equilirium constant for the dimerization of ClO was estimated to be $\sim 10^{-14}$ cm^3/mol. at 298 K. Quantum yields for the decomposition of ozone were also measured. The apparatus is described in the experimental section beginning on page 1636. Cox does not teach a detector for ozone, nitrogen monoxide or nitrogen dioxide.

In the paper Hall presents kinetics of the reaction of nitrate radical (NO_3) with hydroperoxo (HO_2). The kinetics of the title reaction were investigated by molecular modulation-UV visible absorption spectroscopy. NO_3 and HO_2 were generated by modulated photolysis of Cl_2 in the presence of $ClONO_2$, H_2, and O_2 in a flow system at 1 atmosphere pressure and their concentration modulations were monitored by time-resolved absorption at 662 and 220 nm, respectively. The rate coefficient for the overall reaction $NO_3 + HO_2$ products, k_4, was determined by computer fitting to data at 5 temperatures in the range 263-338 K. An upper limit of 0.6 for the ratio k_{4b}/k at 283 K, where k4b is the rate constant for the reaction channel $NO_3 + HO_2$ $OH + NO_2 + O_2$, was established by measurement of OH by modulated resonance absorption. The alternate channel, 4a, produces HNO_3. The introduction discusses assessment

of the role that NO_3 radicals play in atmospheric chemistry. The apparatus is described in the experimental section. Hall does not teach a detector for ozone, nitrogen monoxide or nitrogen dioxide.

In the paper Johnston describes method and apparatus for molecular modulation spectrometry. The method is for observing the infrared spectrum of free radicals at very low concentrations. In the method, the photolyzing light is turned on and off continually, and the concentration of the reactants, intermediates, and products is thereby modulated to a slight extent. When the concentration of a chemical species is varied in a periodic fashion, the absorption which is due to this species is used to modulate a transmitted IR beam intensity. The interesting range of light intensity is 10^{14} to 10^{16} photons/cm^2-second, This intensity is readily obtained by UV fluorescent lamps or low-pressure Hg arcs. At these light intensities, the expected concentration of radicals is ~10^{10} to 10^{13}/cc. and the lifetime of the radicals is ~0.1-10 seconds. The IR path length is 80 meters. The degree of modulation of the beam (-dI/I) is 10^{-4} for typical situations; thus it is desirable to detect a modulation as low as 10^{-6}. By scanning through the IR spectrum, the light intensity is modulated only when one passes through that IR region characteristic of the absorption by a particular radical, reactant, or product. Experiments for the detection of ClO and HO_2 radicals were carried out. Beginning on page 1150 the reaction between NO_2 and O_2 is discussed. Johnston does not teach a detector for nitrogen monoxide or nitrogen dioxide.

In the paper Stuhl discusses measurements of rate constants for termolecular reactions of $O(^3P)$ with nitric oxide, molecular oxygen, carbon monoxide, molecular nitrogen and carbon dioxide using a pulsed vacuum-UV photolysis-chemiluminescent method. Absolute rate constants for a number of termolecular reactions of O atoms were determined at 300 K. O atoms were generated by pulsed vacuum-UV photolyses of NO, O_2, CO_2, and N_2O and were monitored by NO_2* or CO_2* chemiluminescent emission. In the paragraph bridging pages 3943 and 3944 Stuhl teaches that the pulsed technique used, has a high detection sensitivity with fast time resolution. In the first paragraph of the paper Stuhl teaches that the reactions involving $O(^3P)$ play an important role in atmospheric and combustion chemistry. The apparatus is shown

in figure 1 and described on page 3944 in the experimental section. Stuhl does not teach a detector for ozone or nitrogen monoxide.

In the newly cited full article and as admitted on page 1, line 23 to page 2, line 19 of the instant specification Guicherit teaches an indirect method of determining nitrogen oxides by a chemiluminescent method. NO_2 concentrations in outdoor air can be determined indirectly by measuring the equilibrium ozone concentration under continuous UV irradiation. This concentration can be measured very accurately by a chemiluminescence technique using Rhodamine B as a light emitting compound. The equilibrium ozone concentration on photolysis of the NO_2 present is a function of the wavelength, the light intensity, and the temperature. By keeping these parameters constant, NO_2 concentrations can be determined very accurately with a lower detection limit of 5 $\mu g\ NO_2\ m^{-3}$ air. In the introduction and theory sections of the paper Guicherit discusses the reaction as it occurs in the atmosphere. Figure 2 and its associated discussion describe the UV photolysis apparatus used to measure the concentration of ozone. The theory section also describes how the concentration of the other components in the reaction system can be determined from the ozone concentration measurement.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a detector for ozone as taught by Guicherit or modify the systems of Burrows, Cox, Hall, Johnston or Stuhl to be able to detect ozone, nitrogen monoxide, or nitrogen dioxide because of the recognized use of the apparatus of Burrows, Cox, Hall, Johnston or Stuhl to measure species important in atmospheric chemistry and the teachings of Guicherit that the reaction of nitrogen oxides in the atmosphere are important and because of the ability to measure both concentration and lifetimes for reactions that are difficult to measure by other apparatus as taught by Burrows and the high detection sensitivity and fast time resolution as taught by Stuhl.

6. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. The manner in which the claims are amended pointed out that the apparatus and method are substantially similar to the known molecular modulation apparatus and methods, differing in the type of detector used or the species being detected. Additionally the molecular modulation apparatus are well established in their use for examining reaction that are important to atmospheric chemistry. The Guicherit article clearly shows the

specifically claimed gases are important in atmospheric chemistry and that photolysis can be used to alter the concentration of at least one of the claimed gases for measurement purposes. Relative to the drawing objection that was maintained, there was no change to claim 5 and the scope of the claim is not limited to a feature that is shown in the figures. Thus the figures do not show a means for removing one or more of the claimed gases.

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art relates to measurement of photolysis rates or was cited as an abstract in the previous action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose current telephone number is (571) 272-1265 as a result of the examiner moving to the new USPTO location. The examiner's schedule is variable between the hours of about 5:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the examiner at the above telephone number.

Arlen Soderquist

December 31, 2003

SODERQUIST

PRIMARY EXAMINER